

1 METHOD AND SYSTEM FOR TIME-STAMPING AND
2 MANAGING ELECTRONIC DOCUMENTS
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5 FIELD OF THE INVENTION

6 The present invention generally relates to management of
7 electronic documents, and more particularly to time-stamping and
8 managing electronic documents.

9

10 BACKGROUND OF THE INVENTION

11 Various situations require verifying the date on which a
12 document was created. For example, log books, journals,
13 diaries, and engineering notebooks have information that is time
14 sensitive. That is, the date and time at which the information
15 was documented may be important for regulatory compliance or for
16 evidentiary purposes.

17 The advent of electronic documents, for example, word
18 processing documents, appears to have complicated rather than
19 simplified the management of time sensitive documents. Since
20 electronic documents are easily modified, often without evidence
21 of having been changed, it may be desirable to print, time-
22 stamp, and archive a document to preserve evidence of the
23 document's authenticity. Thus, while the characteristics of
24 electronic documents enable quick production and modification,
25 electronic documents may require a redundant process for
26 archival.

27 U.S. patent number 5,136,647, entitled, "Method for Secure
28 Time-Stamping of Digital Documents" to Haber et al. and issued
29 on August 4, 1992 is incorporated herein by reference. Patent
30 5,136,647 addresses some problems related to the certification
31 of electronic documents. The process of patent 5,136,647
32 generally entails generating a certificate as a function of the
33 data comprising the document, the current time, and an
34 assortment of additional data that is described in the patent.

1 The electronic document and certificate can then be stored for
2 later reference, and the authenticity of the electronic document
3 can be later verified by using the stored electronic document
4 and the certificate as described in the patent.

5 The method described in patent 5,136,647 appears to provide
6 a viable solution to the problem of certification of electronic
7 documents. However, as recognized with the present invention,
8 various situations require more than certification of electronic
9 documents. For example, journals, diaries, and engineering
10 notebooks will likely involve generating multiple electronic
11 documents. Thus, archiving the documents and certificates in a
12 manner that provides for easy retrieval may be cumbersome. To
13 further complicate matters, an organization may have many people
14 generating their own electronic documents for journals, diaries,
15 and notebooks, and the documents may have various relationships.
16 Thus, the present invention recognizes the deficiencies of
17 present systems for convenient cataloging and fast
18 identification and retrieval of related documents and their
19 associated certificates. A method and system that address the
20 aforementioned problems, as well as other related problems, are
21 therefore desirable.

22

23 SUMMARY OF THE INVENTION

24 In various embodiments, the invention provides for time-
25 stamping and managing electronic documents. The present method
26 provides a database in which the documents are associated with
27 corresponding time-stamp certificates. Thus, not only can a
28 plurality of documents and their associated time-stamp
29 certificates be easily tracked and retrieved, but various
30 relationships can be established between the documents. For
31 example, in the various embodiments, documents can be related
32 both by subject and chronologically.

33 In accordance with one embodiment, a method is provided for
34 time-stamping and managing electronic documents. The method
35 comprises obtaining respective time-stamp certificates for a

1 plurality of documents, the documents and the certificates
2 having associated identifiers. A database is built using the
3 document identifiers and associated certificate identifiers, and
4 the documents and the certificates are stored for later
5 reference.

6 In another embodiment, a system is provided for time-
7 stamping and managing electronic documents. The system
8 comprises a document manager, a certificate generator, and a
9 database. The document manager is configured and arranged to
10 generate requests for time-stamp certificates for electronic
11 documents, store the documents and corresponding time-stamp
12 certificates, and generate document identifiers and certificate
13 identifiers that respectively correspond to the documents and
14 time-stamp certificates. The certificate generator is coupled
15 to the document manager, and is configured and arranged to
16 generate time-stamp certificates in response to the requests
17 from the document manager. Associations of document identifiers
18 and certificate identifiers that are generated by the document
19 manager are stored in the database.

20 The above summary of the present invention is not intended
21 to describe each disclosed embodiment of the present invention.
22 The figures and detailed description that follow provide
23 additional example embodiments and aspects of the present
24 invention.

25

26 BRIEF DESCRIPTION OF THE DRAWINGS

27 Various aspects and advantages of the invention will become
28 apparent upon review of the following detailed description and
29 upon reference to the drawings, in which:

30 FIG. 1 is a block diagram of an example system for
31 management of time-stamping and certifying electronic documents
32 in accordance with one embodiment of the invention;

33 FIG. 2 illustrates the relationship between database
34 records and documents and certificates stored for a particular
35 user;

1 FIG. 3 is a flowchart of processing performed by a document
2 manager in accordance with an example embodiment of the
3 invention;

4 FIG. 4A shows an example dialog box used to obtain document
5 parameters; and

6 FIG. 4B shows an example dialog box used to obtain a date
7 for browsing documents.

8 While the invention is susceptible to various modifications
9 and alternative forms, specific embodiments thereof have been
10 shown by way of example in the drawings and will herein be
11 described in detail. It should be understood, however, that the
12 detailed description is not intended to limit the invention to
13 the particular forms disclosed. On the contrary, the intention
14 is to cover all modifications, equivalents, and alternatives
15 falling within the spirit and scope of the invention as defined
16 by the appended claims.

17

18 DETAILED DESCRIPTION OF THE DRAWINGS

19 The present invention is believed to be applicable to a
20 variety of systems for time-stamping and managing electronic
21 documents. An "electronic document", as the term is used in
22 this specification, is generally comprised of logically related
23 data. Common examples include, but are not limited to, a word
24 processing file, a spreadsheet file, a digital image file, a
25 digital audio file, a digital video file, and even a database
26 file. Those skilled in the art will appreciate that the present
27 invention is applicable to other types of files in addition to
28 the aforementioned examples. Generally, an electronic document
29 may be viewed as a snapshot of a set of data at a given instant.

30 In accordance with the example embodiments described
31 herein, selected documents are time-stamped by obtaining
32 respective time-stamp certificates, the time-stamped versions of
33 the documents are stored along with the associated certificates,
34 and the documents and certificates are associated in a database.
35 The associations created for the documents and certificates are

1 useful in applications where there are numerous documents to
2 certify and track. For example, journals, log books, and
3 engineering notebooks may include time-sensitive entries for
4 which authentication is desirable or necessary.

5 FIG. 1 is a block diagram of an example system for
6 management of time-stamping and certifying electronic documents
7 in accordance with one embodiment of the invention. System 100
8 includes document manager 102 having certification interface 104
9 and database interface 106. Document manager 102 is coupled to
10 certificate generator 108 via network 110, which is, for
11 example, a wide area network such as the Internet. Documents
12 and certificates that are stored by document manager 102 are
13 illustrated as storage elements 112 and 114, respectively. It
14 will be appreciated that storage elements 112 and 114 are
15 separate for purposes of illustration only, and that documents
16 and certificates could be stored together or separately on one
17 or more devices using conventional file storage techniques.
18 Document manager 102 is also coupled to database 116 via
19 database interface 106.

20 Document manager 102 receives as input a document and
21 associated parameters, as illustrated by line 120. The document
22 is packaged with a certification request by certification
23 interface 104 and sent to certificate generator 108. Digital
24 Notary™ software from Surety Technologies can be used, for
25 example, for certificate interface 104 and certificate generator
26 108. ("Digital Notary" is a trademark of Surety Technologies.)
27 Certification interface 104 applies a one-way hash function to
28 generate a digital fingerprint that is transmitted to
29 certificate generator 108. Certificate generator 108 generates
30 a time-certified digital certificate that seals the document and
31 returns the certificate to the requester. U.S. patent number
32 5,136,647 further describes the example certification method.
33 Other time-stamping and certification methodologies recognized
34 by those skilled in the art may also be used in accordance with
35 the present invention.

1 Having received the certificate from certificate generator
2 108, document manager 102 stores the document and certificate so
3 that they can be examined at a later time if the need arises.
4 In addition, a document identifier and certificate identifier
5 are associatively stored in database 116. The database
6 association enables fast retrieval of the document and
7 associated certificate should the need arise to verify the
8 authenticity of the document. In one embodiment, in addition to
9 the document identifier and certificate identifier, database 116
10 also includes an associated time-stamp, subject, description,
11 and a thread to chronologically link a document to other related
12 documents. Thus, database 116 provides easy perusal of the
13 various documents and the associated time-stamps, descriptions,
14 and subjects, as well as relationships between the documents.
15 Various conventional database systems, such as Microsoft Access,
16 are suitable to implement database 116.

17 System 100 includes an outside agency, i.e., certificate
18 generator 108, that provides the time-stamp certificate.
19 However, it will be appreciated that in an alternative
20 embodiment, the certificate generator could be integrated with
21 the functionality of the document manager.

22 Document manager 102 can be implemented in a client-server
23 arrangement or as a stand-alone personal computer. Thus,
24 documents can be managed for a single or multiple users,
25 depending upon application requirements.

26 FIG. 2 illustrates the relationship between records of
27 database 116 and documents and certificates stored for a
28 particular user. An example hierarchy of certificates and
29 documents is shown in the upper portion of FIG. 2, and an
30 example set of database records from database 116 is depicted as
31 blocks in the lower portion of FIG. 2. There is a one-to-one
32 correspondence between each database record and a
33 document/certificate pair. For example, record 162 is
34 associated with document "doc-1" and certificate "cert-1". Note
35 that line 164 indicates that the document-ID field references

1 doc-1, and line 166 indicates that the certificate-ID field
2 references cert-1. Records 168 and 170 reference the
3 certificates and documents as shown. It will be appreciated
4 that records 172, 174, and 176 reference other ones of the
5 certificates and documents, even though the directional lines
6 are not connected to the specific certificates and documents.
7 The directional lines for records 172-176 are not connected to
8 the certificates and documents so as not to clutter the diagram.

9 In addition to the document-ID and certificate-ID, each
10 database record also includes a time-stamp, subject,
11 description, and thread. The time-stamp can be generated by the
12 document manager when the document is submitted for
13 certification and can include the date and time. The subject is
14 supplied by the user for the purpose of categorizing related
15 documents. For example, the subject may be a project
16 designation, an event designation, a technology designation, or
17 any other designation suitable to the subject matter of the
18 certified documents. The description can be a textual
19 description of the document, for example.

20 The thread field of a database record is used to
21 chronologically link the document to other related documents.
22 For example, records 162-170 are linked with the thread fields
23 as indicated by the directional lines. Note that each of the
24 records has a forward link and a backward link, and that a
25 thread has a first record and a last record. Specifically,
26 record 162 is the first record in the thread, and record 170 is
27 the last record in the thread. Thus, document "doc-1" is the
28 first document in the example thread, document "doc-2" is the
29 second document in the thread, and one of the documents between
30 doc-3 and doc-n is the last document in the thread. The forward
31 and backward links in the thread field enable forward and
32 backward traversal of documents in a thread. Note that the
33 backward link for the thread field of record 162 is null, as
34 indicated by the "X" (because record 162 is the first record in
35 the thread), and the forward link for the thread field of record

1 170 is null (because record 170 is the last record in the
2 thread). The order in which documents are linked to the thread
3 indicates the relative time at which time-stamp certificates
4 were generated for the respective documents, and the documents
5 were added to the thread. Suitable implementations for
6 threading the time-stamped documents can be found in various e-
7 mail, chat-room, and bulletin board systems.

8 While records 162-176 are shown as referencing documents
9 and certificates for a single user, it will be appreciated that
10 a single database could be constructed to associate documents
11 and certificates for multiple users. In particular, multiple
12 users could use the same set of subjects and threads when adding
13 documents to the database, thereby providing links between the
14 documents of different users. Various security levels could
15 also be implemented so that selected users would have access to
16 selected subjects and threads.

17 FIG. 3 is a flowchart of processing performed by document
18 manager 102 in accordance with an example embodiment of the
19 invention. Document manager 102 provides three user-selectable
20 example functions: add, query, and browse. The functions can
21 be made accessible with a point-and-click, menu, or command
22 based interface.

23 For the add function, step 202 directs control to step 204
24 to obtain the parameters for the document to add to database 116
25 (FIG. 1). Before continuing with the process of FIG. 3, FIG. 4A
26 shows an example dialog box 206 used to obtain document
27 parameters for the add function and is described in the
28 following paragraphs.

29 Dialog box 206 includes data entry fields 208, 210, 212,
30 and 214 for the user to enter a document identifier, a
31 description, a subject, and a thread identifier, respectively.
32 Data entry fields 208-214 correspond to the database fields
33 described above for FIG. 2. Dialog box 206 also includes browse
34 buttons 216, 218, and 220 that are associated with the document,
35 subject, and thread fields 208, 212, and 214, respectively.

1 Document manager 102 allows the user to navigate a hierarchy of
2 files (not shown) that are accessible to the user in response to
3 selection of browse button 216. In the browse mode, the user
4 can select the desired document by clicking on a document
5 identified in a list of documents, for example. A comparable
6 browse capability is provided by the various operating systems
7 from Sun Microsystems, Inc. of Palo Alto, California, Apple
8 Computer, Inc. of Cupertino, California, and Microsoft
9 Corporation of Redmond, Washington.

10 When the user selects browse button 218, document manager
11 102 presents a list of subjects defined in database 116, for
12 example. This button allows the user to associate the document
13 to be certified with a previously defined subject. For example,
14 an engineer can create a document to describe an invention
15 related to a particular project, product, or technology. If
16 particular projects, products, and technologies have been
17 previously created, the engineer can browse the subjects and
18 make the desired selection. To create a new subject, button 222
19 is provided. Document manager 102 solicits a subject name from
20 the user in response to selection of button 222, for example,
21 with another dialog box. While not shown, it will be
22 appreciated that a database table for all the subjects in
23 database 116 may be desirable.

24 When the user selects browse button 220, document manager
25 102 presents a list of threads defined in database 116, for
26 example. This button allows the user to link the document to be
27 certified to previously certified documents. For example, an
28 engineer can create a document that describes various
29 refinements to an invention. If the invention has been
30 previously described in one or more documents that have been
31 linked by a thread, the most recent document can be appended to
32 the thread by browsing and selecting the desired thread. It is
33 expected that threads have names that reflect a theme common to
34 the linked documents, for example, a name or number that
35 identifies an invention. To create a new thread, button 224 is

1 provided. Document manager 102 solicits a thread identifier
2 from the user in response to the selection of button 224, for
3 example, with another dialog box. While not shown, it will be
4 appreciated that a database table for all the threads in
5 database 116 may be desirable, and that each thread in the table
6 references the first record (e.g., 162 of FIG. 2) in the thread.

7 Document manager 102 continues processing at step 226 of
8 FIG. 3 when submit button 228 (FIG. 4A) is selected. The
9 document is certified at step 226. As described above, document
10 manager 102 can certify the document with locally provided
11 functionality or can have the document certified by an outside
12 agency, which may be preferable if the document and
13 certification may eventually be used as objective evidence.

14 If no thread was specified in dialog box 206, step 230
15 directs control to step 232 where a database record is added for
16 the document, certificate, and subject and description
17 parameters if specified. The document and certificate are then
18 stored at step 234, for example in accordance with the file
19 system hierarchy shown in FIG. 2. Centralized storage may be
20 desirable for documents and certificates in a network-based
21 system 100 where multiple users interface with document manager
22 102. After the document and certificate have been stored, the
23 process is complete.

24 If a user specified a thread for a document, step 230
25 directs control to decision step 236. For a thread that already
26 exists in database 116, a record is added to the database for
27 the document, certificate, and subject and description
28 parameters if specified, as shown by step 238. The added record
29 is linked to the end of the specified thread (see, for example,
30 record 170 of FIG. 2). Processing continues at step 234 as
31 described above.

32 Decision step 236 directs control to step 240 if the
33 document is to begin a new thread. For the first document in a
34 thread, the database record is referenced by a thread identifier
35 to indicate that the document is the first. As set forth above,

1 a separate table may be desirable for the various thread
2 identifiers. Processing then continues at step 234 as described
3 above.

4 If the user selects a query function, decision step 202
5 directs control to step 242, where document manager 102 obtains
6 the parameters to be used in searching database 116. The
7 parameters can be one or more of the parameters illustrated in
8 dialog box 206 of FIG. 4A. Conventional methods can be used to
9 search database 116 for matching records (step 244) and output
10 the results (step 246).

11 If the user selects the browse option, decision step 202
12 directs control to step 248, where document manager 102
13 determines the earliest date of interest. This date can be
14 determined as illustrated in dialog box 260 of FIG. 4B. The
15 default date is the earliest date corresponding to a record in
16 the database. The process is then directed to step 250 where
17 the user is presented with a list of documents in chronological
18 order, beginning with the date of interest.

19 The user may select a desired document from the
20 chronologically sorted list of records by clicking on a document
21 identified in the list.

22 Accordingly, the present invention provides, among other
23 aspects, a method and system for time-stamping and managing
24 electronic documents. Other aspects and embodiments of the
25 present invention will be apparent to those skilled in the art
26 from consideration of the specification and practice of the
27 invention disclosed herein. It is intended that the
28 specification and illustrated embodiments be considered as
29 examples only, with a true scope and spirit of the invention
30 being indicated by the following claims.